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Spectroscopic Results for the Motions of Stars in the Line of Sight, obtained at the Royal Observatory, Greenwich.

(*Communicated by the Astronomer Royal.*)

The results here given are in continuation of those printed in the *Monthly Notices* for 1875, November, but for convenience of reference, those of the former measures which are considered trustworthy are repeated, together with the more recent results, and the means of the whole taken in the case of those stars which have been satisfactorily observed. Where no mean is set down the result is to be considered as still uncertain. Observations have been enclosed in brackets and rejected in forming the means, in cases where no estimation of the displacement was made, or where the measured and estimated motions differed by more than 50 miles a second. In the one case the circumstances were evidently very unfavourable, in the other there is a strong presumption of error. The estimated motions are given as a check on the micrometer measures, being made independently. The motions actually observed may be inferred from the concluded motions by algebraic addition of the corresponding Earth's motion.

The weights given are on a scale of 1 to 5 for each measure; in some few instances a weight of $\frac{1}{2}$ has been given when the observation appeared very uncertain. The width of the slit has been given, as this has an important bearing on the question of displacement; in some of the observations too wide a slit has been inadvertently used, but recently care has been taken to limit the width to $3^{\text{div.}}$, or about 0·004 inch as a maximum. The apparent diameter of the image of a third magnitude star is about $4^{\text{div.}}$, or 0·005 inch.

The only instrumental changes made since last November are: The adaptation to the small telescope of a bright-line micrometer on a new principle, by Mr. Hilger, which has been used regularly from 1875, November 29; an alteration in the angle of the "half-prism" with which the train commences, so as to decrease the deviation of the pencil passing through it, by about 5°, in order that it might pass through the other prisms of the train at the angle of minimum deviation, and the insertion of a Barlow lens in the small telescope, increasing the power to 23. These changes were completed 1876, February 18.

All the comparisons have been made by means of two comparison-prisms in connection with a collimating lens, throwing an image of the comparison-light on the slit, immediately above and below that of the star. The interval between these comparison-prisms can be decreased at pleasure, till they are brought into contact.

The results which follow are arranged in order of Right Ascension of the stars observed. The measures of the Moon have been made as a check on the system of observation.

Royal Observatory, Greenwich,
1876, *May* 12.

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Motions of Stars in the Line of Sight in Miles per Second.

(+ denotes Recession; − Approach.)

$1^{\text{div.}}$ in the width of the slit corresponds to 0·0013 inch.

Date.		Observer.	No. of Measures.	No. of Prisms.	Width of Slit.	Line.	Earth's Motion in Miles per Sec.	Concluded Motion of Star. Mea-sured.	Concluded Motion of Star. Esti-mated.	Remarks.
								α Andromedæ.		
1875	July 29	M	2	1½	d 2·6	F	−14·8	−14·7	−11·2	Star line faint; sky hazy; weight 2.
	Aug. 4	M	2	1½	2·9	F	−14·1	− 6·5	−17·2	Indirect comparison; weight 2.
	30	M	2	1½	2·6	F	− 9·5	−28·3	−36·0	Indirect comparison; star line rather faint from cloud; weight 2.
	Dec. 17	M	2	2½	3·1 & 4·2	F	+16·3	−39·2	−44·9	Indirect comparison; star line rather faint, but better seen than on any previous occasion; weight 4.
	22	M	2	2½	2·9	F	+16·7	−71·3	−79·6	Direct comparison; wind very high and images very unsteady; weight 2.
							Mean	−33·	−39·	
								Aldebaran.		
1875	Nov. 29	M	2	1½	2·7	b_1	− 0·3	(+135·0)	(+80·8)	Comparison doubtful, the lines being very faint, and there being several close together.
	Dec. 17	M	1	2½	6·7	b_1	+ 5·7	+35·1	+48·7	Line confused with others near; weight ½.

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Date.	Observer.	No. of Measures.	No. of Prisms.	Width of Slit.	Line.	Earth's Motion in Miles per Sec.	Concluded Motion of Star.		Remarks.
							Mea-sured.	Esti-mated.	
								Capella.	
1875 Nov. 29	M	2	1½	d 3·0 & 2·1	F	− 3·8	+48·3	+55·2	Weight 2; line very difficult to see.
Dec. 22	M	3	2½	2·5	F	+ 3·2	+11·0	+19·1	Direct comparison; weight 13; star line seen better than ever before.
						Mean	+16·	+24·	
								Rigel.	
1875 Dec. 22	M	2	2½	3·4, 3·7	F	+ 4·4	+25·2	+26·7	Wind high; line faint; weight 5.
								α *Orionis.*	
1876 Mar. 15	M	2	1½	2·1	b_4	+17·8	+67·1	+92·0	Star line very dark; weight 4. } Telescope not very firm.
15	M	1	1½	2·4	b_1	+17·8	+93·8	+48·1	Weight 4. }
						Mean	+76·	+77·	
								β *Aurigæ.*	
1875 Nov. 29	M	2	1½	1·3	F	− 6·4	(−128·2)	(−60·5)	Star line broad and ill-defined at edges; weight 8.
								Sirius.	
1875 Dec. 22	M	2	2½	3·3 & 3·8	F	− 2·9	+31·1	+29·6	Direct comparison showed a small but distinct displacement to red; weight 10.
1876 Feb. 24	M	2	2½	2·1 & 1·7	F	+11·6	+13·9	+32·5	Very hazy; weight 4.
Mar. 17	M	2	2½	4·2 & 3·0	F	+13·8	+16·4	+22·1	Line very marked; star steady and clear; weight 10.
						Mean	+22·	+27·	

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Castor.

1875	Dec. 17	M	2	2½	5·5	F	− 7·3	+ 61·3	+ 41·1	Weight 4.
1876	Feb. 23	M	2	2½	2·1 & 2·2	F	+ 13·3	+ 24·2	+ 13·7	Very tremulous; weight 5.
	Mar. 17	M	2	2½	3·1 & 1·0	F	+ 17·0	+ 15·5	+ 22·5	Weight 8; direct comparison showed a slight displacement to red.
							Mean	+ 29·	+ 24·	

Procyon.

1875	Dec. 17	M	2	2½	5·0	F	− 8·6	+ 34·3	+ 35·1	Weight 4; lines appeared nearly coincident; images steady, but spectrum not bright.
1876	Mar. 17	M	2	2½	1·0 & 1·4	F	+ 15·9	+ 59·4	+ 54·5	Weight 9; direct comparison showed a displacement to red greater than *Castor* or *Sirius*.
	Apr. 3	M	2	2½	1·1	F	+ 17·3	+ 33·7	+ 19·7	Weight 6; line faint and ill-defined; direct comparison showed a considerable displacement to red.
							Mean	+ 46·	+ 39·	

Pollux.

1876	Mar. 15	M	2	1½	1·5, 1·9	b_4	+ 16·4	− 127·9	− 86·5	Star line very faint; measure rather wide; weight 3; telescope not very firm.

Regulus.

1876	Feb. 23	M	2	2½	0·6 & 1·4	F	+ 2·2	+ 11·6	+ 21·4	Weight 6.
	Mar. 17	M	2	2½	4·1 & 3·1	F	+ 9·1	+ 47·8	+ 43·9	Weight 7.
	Apr. 8	M	2	2½	1·9 & 2·9	F	+ 14·2	+ 32·1	+ 34·1	Weight 8; star line dark, but wind high.
	May 6	M	1	2½	1·4	F	+ 17·6	+ 32·8	+ 15·9	Weight 1; star line very faint, and measure doubtful.
							Mean	+ 32·	+ 33·	

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Date.	Observer.	No. of Measures.	No. of Prisms.	Width of Slit.	Line.	Earth's Motion in Miles per Sec.	Concluded Motion of Star. Mea-sured.	Concluded Motion of Star. Esti-mated.	Remarks.
								γ Leonis.	
1876 Mar. 15	M	3	1½	d 3·2, 2·5	b_1	+ 8·5	−71·3	−65·7	Star line not very pronounced; weight 6; telescope not very firm.
								β Ursæ Majoris.	
1876 May 1	M	3	2½	3·0, 1·5	F	+12·6	+15·5	+15·4	Line evidently displaced to red, but neither spectrum nor line well seen; weight 7.
								α Ursæ Majoris.	
1876 May 1	M	2	2½	1·5	F	+11·6	−37·1	−40·3	Direct comparison showed a slight displacement to blue; weight 4.
								β Leonis.	
1876 Apr. 8	M	2	2½	1·9	F	+ 8·8	−32·7	−31·0	Star line exceedingly difficult to see; weight 2.
								Spica.	
1876 Feb. 23	M	2	2½	1·8	F	−13·0	+37·2	+50·1	Definition poor; weight 4.
								η Ursæ Majoris.	
1875 June 11	M	2	2	...	F	+10·3	(+37·4)	...	Star line very faint, and not often seen; readings uncertain.
25	M	2	2	22·4 & 9·5	F	+10·4	(−65·1)	(−102·2)	Star line scarcely visible; result uncertain, on account of the width of the slit.
July 12	M	1	2	2·3	F	+ 9·4	−43·5	−23·5	Star line very faint, and bisection uncertain; displacement small; weight 1.
1876 May 1	M	2	2½	2·2	F	+ 7·6	−26·5	−38·2	Weight 6 line fairly well seen.
						Mean	−29·	−36·	

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Arcturus.

1876 Mar. 15	M	2	1½	2·2, 1·6	b_1	+ 7·1	−47·9	−43·7	Weight 10.
15	M	2	1½	3·0	D_2	− 7·1	−47·6	−33·5	Weight 2; D lines not seen nearly so well as the *b* lines.
Apr. 8	M	4	2½	0·9, 1·5	F	− 0·8	−16·0	−16·1	Weight 8; measures somewhat uncertain, as there was much mist, and the Moon was very bright.
May 6	M	2	2½	4·4	F	+ 6·4	−33·2	−47·0	Weight 4; very poorly seen.
						Mean	−35·	−34·	

ε Boötis.

1876 Mar. 15	M	2	1½	3·6	b_1	− 7·1	− 4·6	−13·3	Line faint; weight 4; image tremulous; telescope not very firm.

α Coronæ.

1875 June 25	M	1	2	1·5	F	+ 10·2	(−119·3)	(−30·5)	The two lines could not be directly compared; star line dark, and very broad and nebulous.
1876 Apr. 8	M	2	2½	2·2	F	− 4·7	+ 59·9	+ 45·5	Weight 1; measures very doubtful.

α Ophiuchi.

1875 June 25	M	2	2	2·7	F	+ 3·3	−26·6	−25·1	Indirect comparison; spectrum faint; star line slightly displaced to blue.
July 12	M	2	1½	2·1, 1·5	F	+ 7·1	(+154·3)	(+88·5)	Star line very faint, and not well seen.

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Date.		Observer.	No. of Measures.	No. of Prisms.	Width of Slit.	Line.	Earth's Motion in Miles per Sec.	Concluded Motion of Star.		Remarks.
								Mea-sured.	Esti-mated.	
									Vega.	
					d					
1875	June 25	M	2	2	2·3	F	− 1·4	−47·7	−24·8	
	26	WC	2	2	3·2, 1·8	F	− 1·3	−16·2	−19·4	Everything in good adjustment.
	July 8	M	3	2	1·4	F	+ 0·4	−39·0	−13·6	
	12	M	2	1½	0·5, 1·6	F	+ 0·9	−46·5	−65·5	Definition good.
	29	M	2	1½	2·1, 2·3	F	+ 3·2	−37·7	−39·2	Direct comparison.
	31	M	2	1½	2·8	F	+ 3·5	−54·1	−57·6	Very bright indeed; direct comparison.
	31	M	2	2½	5·1, 4·5	F	+ 3·5	−53·1	−35·8	
	Aug. 30	M	3	2½	2·0, 2·4	F	+ 6·9	−49·0	−34·1	Sky hazy at times.
	Sept. 3	M	2	3½	2·0	F	+ 7·2	−28·9	−23·9	Line broad and nebulous, and not very distinctly seen; indirect comparison.
1876	May 1	M	2	2½	3·1, 1·5	F	− 7·5	−17·4	−40·0	Weight 8; air steady, but sky hazy.
							Mean	−39·	−35·	
									Altair.	
1875	June 26	WC	2	2	2·5, 3·1	F	− 6·7	(−102·1)	(−25·5)	Everything in good adjustment.
	July 8	M	2	2	2·5	F	− 3·7	−58·2	−23·9	Star line not well seen.
	12	M	2	1½	1·6	F	− 2·7	(+105·6)	(+85·4)	Direct comparison doubtful; star line faint, broad, and ill-defined.
	29	M	2	1½	1·5, 2·7	F	+ 1·7	−81·3	−77·1	Indirect comparison; star line very faint.

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Altair—continued.

31	M	1	2½	4·1	F	+ 2·2	+13·8	+21·2	The observations are discordant.
31	M	2	1½	4·1	F	+ 2·2	−22·2	...	
Aug. 4	M	2	1½	4·1, 2·4	F	+ 3·3	−86·8	−62·1	Direct comparison.
30	M	2	2½	2·5	F	+ 9·5	−61·4	−57·5	
Dec. 22	M	1	2½	...	F	+ 8·1	...	...	Star line seen considerably displaced to the blue, but no measures could be obtained.

α Cygni.

1875 July 29	M	2	1½	2·8, 2·2	F	− 4·1	(+58·1)	(+80·5)	Star line faint.
31	M	2	1½	3·6, 4·6	F	− 3·8	−69·7	−79·7	Indirect comparison; weight 6.
Aug. 2	M	2	1½	2·3, 1·9	F	− 3·6	−53·2	−47·6	Indirect comparison; weight 6.
30	M	1	2½	2·1	F	+ 0·5	(−20·7)	...	Nearly coincident.
30	M	1	1½	2·1	F	+ 0·5	−31·7	−35·5	Indirect comparison; weight 3.
Nov. 29	M	1	1½	4·4, 4·5	F	+ 9·7	−36·4	−33·4	Indirect comparison; star line faint; nearly coincident; weight 6.
						Mean	−50·0	−51·0	

α Pegasi.

1875 July 29	M	2	1½	3·1, 3·6	F	−12·0	−10·3	−13·7	Indirect comparison; star line broad and dark; slightly displaced to blue; weight 4.
Aug. 4	M	2	1½	2·5	F	−10·7	−20·5	−14·8	Indirect comparison; weight 4.
30	M	2	1½	2·7, 3·1	F	− 4·3	−66·3	−39·5	Indirect comparison; weight 4.
						Mean	−32·	−22·	

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Date.		Observer.	No. of Measures.	No. of Prisms.	Width of Slit.	Line.	Earth's Motion in Miles per Sec.	Concluded Motion of Star.		Remarks.
								Measured.	Estimated.	
									Moon.	
					d					
1876 April	3	M	1	2½	...	F	...	− 2·6	...	Moon line very faint, much fainter than the line in *Procyon*, but not harder to bisect as it was of course narrow and sharp. The spectroscope seemed in good adjustment.
	,,	M	1	2½	...	F	...	− 0·3	...	
	,,	M	1	2½	...	F	...	+ 7·9	...	
	,,	M	1	2½	...	F	...	− 3·0	...	
	,,	M	1	2½	...	F	...	+ 1·3	...	
	,,	M	1	2½	...	F	...	− 0·8	...	
	,,	M	1	2½	...	F	...	+ 8·9	...	
	8	M	1	2½	...	F	...	− 9·4	...	Moon line fairly well seen, but faint.
	,,	M	1	2½	...	F	...	+ 13·7	..	Sharp but faint.
May	1	M	1	2½	...	F	...	− 1·5	...	Line very faint, and more difficult to bisect than the line in the spectrum of a large star would be.
	,,	M	1	2½	...	F	...	+ 9·1	...	
	,,	M	1	2½	...	F	...	+ 10·1	...	
	3	M	1	2½	...	F	...	+ 4·0	...	Moon line seen better than on any previous occasion.
	,,	M	1	2½	...	F	...	− 4·1	...	Not quite so good, but very nicely seen.
	6	M	1	2½	...	F	...	− 5·3	...	Moon line very well seen, easier to measure than *Vega* even.
	,,	M	1	2½	...	F	...	+ 4·8	...	
							Mean	+ 2·0		

The initials W. C. and M. are those of Mr. Christie and Mr. Maunder respectively,